PTT Exploration and Production Public Company Limited

PTTEP Engineering General Specification

PEGS

Pipes, Flanges, Fittings and Bolting for Piping

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PTT Exploration and Production Public Company Limited

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0-0	New document, update division code as new PTTEP organization (1 Jan 2015).		

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1.0 PURPOSE

The purpose of this specification is to provide the requirements for the supply of piping components to be used in the construction of all PTTEP process and utility piping systems.

2.0 SCOPE

This specification defines the COMPANY requirements for the supply of piping components (gaskets and valves are excluded) to be used in all process piping and utility piping systems including piping in instrumentation packages.

This specification shall be used in conjunction with the project particular specification (PPS) detailing the additional requirements or possible amendments to the present specification based on design conditions particular to the project.

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3.0 DEFINITIONS

A number of different terms are commonly used to describe the work stages, processes, and approvals which take place during the early stages of a development. This can often be a source of confusion so the following section is intended to show the PTTEP preferred terminology as used in this document.

3.1 LANGUAGE

In this document, the words should and shall have the following meanings:

Should	Indicates a preferred course of action. Should is a non-mandatory word and is not forbidden, but use in the body of the text should be the exception. Where none mandatory terms are used, each paragraph within these clauses shall also have an associated commentary paragraph that provides the rationale for why the stated choices and modifications are appropriate and circumstance under which the stated choices and modifications might be different.
Shall	Indicates a course of action with a mandatory status. The term “shall” shall be used if a requirement is considered to be necessary to claim compliance with a PEGS document.

3.2 TERMINOLOGY

Terminology	Description
Approval	The authorization in writing given by the COMPANY to the Contractor on a procedure or to proceed with the performance of a specific part of the work without releasing in any way the Contractor from any of his obligations to conform with the technical specifications, requisitions, etc. The words “Approve”, “Approved” and “Approval” shall be construed accordingly
COMPANY	PTT Exploration and Production Public Company Limited
Contract	"Contract" means this signed agreement together with the Exhibits and Annexes which are made part thereof, and any future amendments thereto.
Contractor	Per contract: Contractor – ‘The contractor who is a party to this Contract and where the context so requires, any and all subcontractors utilised by Contractor for the performance of the WORK’
Manufacturer	The Company or its sub-contractor(s) selected by the COMPANY or the Supplier (as applicable) as the Manufacturer(s) of the said materials.
Mill	The plants, mills, workshops, laboratories or other locations where the fabrication, inspection and testing of materials are to be performed complete or in part.
PPS	Designates Project Particular Specification detailing the additional tests and requirements or the possible modifications to the present specification, based on the particular design conditions or the local legislation of the project.
Vendor or Supplier	The COMPANY or its agents designated on the Purchase Order or Contract as being the selected Supplier of the said materials.

3.3 COMMON ACRONYMS

Set out below in alphabetical order are common acronyms as found within this document:

API	American Petroleum Institute
ASTM	American Society for Testing and Materials

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Br	Bronze
BW	Butt Weld
CE	Carbon Equivalent
Cr	Chromium
CS	Carbon Steel
Cu-Ni	Copper-Nickel
DPI	Dye penetrant inspection
EFW	Electric Fusion Welded
ERW	Electric Resistance Welded
Gr	Grade
GRE	Glass Reinforced Epoxy
GRP	Glass Reinforced Plastic
HAZ	Heat-Affected Zone
MDMT	Minimum Design Metal Temperature
Mn	Manganese
Mo	Molybdenum
MPI	Magnetic particle Inspection
MSS	Manufacturers Standardization Society
NPS	Nominal Pipe Size
NPT	National Pipe Thread
PMI	Positive Material Identification
PTFE	Polytetrafluoroethylene (Teflon)
RTJ	Ring Joint
SAW	Submerged Arc Welding
SS	Stainless Steel
V	Vanadium
WN	Weld Neck

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4.0 REFERENCES

The reference documents listed below, including Industry Codes and Standards and COMPANY specifications, form an integral part of this Engineering General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published on the effective date of a contract.

The overall order of precedence of the applicable documents shall be:

1. Applicable Laws, Rules and Regulations of the country in which the system/equipment will be operated (if any);
2. Purchase Order/ Service Order/ Contract Documents (Only applicable for direct purchase by COMPANY);
3. Project Particular Specification (PPS), and relevant data sheet(s) if any;
4. COMPANY General Specification;
5. Codes and Standards in reference.

Any conflict between any of the Contract Documents, or between this specification and any other Contract Document, shall be reported to COMPANY for decision. In such a case, and unless otherwise agreed or decided by COMPANY, it is understood that the more stringent requirement shall apply.

Exceptions to, or deviations from this specification are not permitted unless previously accepted in writing by COMPANY. For this purpose, requests for substitutions or changes of any kind shall be complete with all pertinent information required for COMPANY assessment. COMPANY's approval, nevertheless, will not, in any way, relieve the responsibility of the Contractor to meet the requirements of the industry Codes and Standards referred to and amended herein, in the event of conflict.

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4.1 PTTEP INTERNAL REFERENCES

Internal documents applicable to this document are indicated in the table below.

Document Number	Document Title
PEGS-0250-ADM-001	Minimum Requirements for Contractors final documentation
PEGS-0250-ADM-002	Minimum Requirements for Vendors documentation
PEGS-0710-ADM-006	Quality Requirements for Vendor
PEGS-0710-INS-002	Instrumentation Engineering, Supply and Construction General Requirement
PEGS-0710-PIP-001	Piping design, Fabrication and Installation
PEGS-0710-PIP-007	Piping Material Classes
PEGS-0710-PIP-008	Piping Glass-Reinforced Plastic (GRP), Design and Installation, Tubes & Accessories.
PEGS-0710-PIP-012	Piping Fabrication and Welding of Cupronickel and Associated Materials
PEGS-0710-PIP-018	Piping and Equipment subjected to Intermediate Sour Service
PEGS-0710-PIP-019	Piping and Equipment subjected to Severe Sour Service
PEGS-0710-PIP-020	Piping or Pressure Vessel Components in Duplex and Super Duplex Stainless Steel
PEGS-0710-PIP-030	Design and Erection of Grass Rein Forced Plastic (GRP) Piping System
PEGS-0710-PIP-031	Offshore Facilities: Glass-Reinforced Plastic Piping Materials (Tubes and Accessories)
PEGS-0790-FAB-001	Welding of Pressure Containing Piping and Equipment
PEGS-0842-COR-010	Painting of Offshore and Coastal Structures and Facilities
PEGS-0842-COR-011	Painting of Onshore Structures and Facilities
PEGS-0842-COR-032	Materials for Sour Service
PEGS-0842-INT-001	Inspection and Testing Requirements

4.2 INTERNATIONAL STANDARDS

International standards applicable to this document are indicated in the table below i.e. ISO, IEC or ITU.

Document Number	Document Title
ISO 10423 / API 6A	Petroleum and natural gas industries – Drilling and production equipment – Wellhead and Christmas tree equipment
ISO 14692	Specification and Recommended Practice for the Use of GRE Piping in the Petroleum or Natural Gas Industries
ISO 9001	Quality Management Systems - Requirements

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Document Number	Document Title
ISO/IEC 17020	General Criteria for The Operation of Various Types of Bodies Performing Inspection
ISO/IEC 17025	General Requirements for The Competence of Testing and Calibration Laboratories
ISO/TS 29001	Petroleum, Petrochemical and Natural Gas Industries Specific Quality Management Systems
NACE MR 0175 / ISO 15156	Material Requirements- Sulfide Stress Cracking Resistant Metallic Materials for Oilfield Equipment

4.3 INDUSTRY CODES AND STANDARDS

Industry codes, standards and regional legislation applicable to this document are indicated in the table below.

Document Number	Document Title
API 15LR	Low Pressure Fiberglass Line Pipe and Fittings
API 20E	Alloy and Carbon Steel Bolting for Use in the Petroleum and Natural Gas Industries
API 5L	Line Pipe
API RP 14E	Design and Installation of Offshore Production Platform Piping Systems
API RP 578	Material Verification Program for New and Existing Alloy Piping Systems
ASME B1.1	Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B1.2	Gauges and Gauging for Unified Screw Threads
ASME B1.20.1	Pipe threads, General Purpose (inch)
ASME B16.11	Forged Fittings, Socket Welding and Threaded
ASME B16.24	Cast Copper Alloy Pipe Flanges, Class 150, 300, 400, 600, 900, 1500 and 2500 and Flanged Fittings Class 150 and 300
ASME B16.25	Butt Welding Ends
ASME B16.28	Wrought Steel Butt Welding Short Radius Elbows and Returns
ASME B16.36	Steel Orifice Flanges, Class 300, 600, 900, 1500 and 2500
ASME B16.47	Large Diameter Steel Flanges NPS 26 through NPS 60
ASME B16.48	Line Blanks
ASME B16.5	Pipe Flanges and Flanged Fittings
ASME B16.9	Factory-Made Wrought Steel Butt Welding Fittings
ASME B18.2.1	Square and Hex Bolts and Screws (Inch series)
ASME B18.2.2	Square and Hex Nuts (Inch series)
ASME B31.3	Process Piping

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Document Number	Document Title
ASME B31.4	Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids
ASME B31.8	Gas Transmission and Distribution Piping Systems
ASME B36.10M	Welded and Seamless Wrought Steel Pipe
ASME B36.19M	Stainless Steel Pipe
ASME B46.1	Surface Texture
ASME IX	Boiler and Pressure Vessel Code - Section IX – Welding and Brazing Qualifications
ASME V	Boiler and Pressure Vessel Code - Section V - Non Destructive Examination
ASME VIII	Boiler and Pressure Vessel Code - Section VIII Div. 1 and Div. 2 - Rules for Construction of Pressure Vessels
ASTM A123	Standard Specification for Zinc Coating (Hot-Dip Galvanized) Coating on Iron and Steel Products
ASTM A153	Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware
ASTM A262	Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels
ASTM A370	Test Methods and Definitions for Mechanical Testing of Steel Products
ASTM A435	Straight-Beam Ultrasonic Examination of Steel Plates
ASTM A450	General Requirements for Carbon, Ferritic Alloy, and Austenitic Alloy Steel Tubes
ASTM A530	General Requirements for Specialized Carbon and Alloy Steel Pipe
ASTM A700	Packaging, Marking, and Loading Methods for Steel Products for Domestic Shipment
ASTM B633	Electrodeposited Coatings of Zinc on Iron and Steel
ASTM D1418	Practice for Rubber and Rubber Lattices- Nomenclature
ASTM D2310	Machine-Made “Fibreglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D2996	Filament-Wound “Fibreglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM E165	Test Methods for Liquid Penetrant Inspection
ASTM E446	Standard Reference Radiographs for Steel Castings Up to 2 in. (50.8 mm) in thickness
ASTM E709	Standard Guide for Magnetic Particle Testing
ASTM F152	Standard test method for tension testing of nonmetallic gasket materials
ASTM F36	Standard test method for compressibility and recovery of gasket materials
ASTM G48	Test Methods for Pitting and Crevice Corrosion Resistance of Stainless Steel and Related alloys by Use of Ferric Chloride Solution

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Document Number	Document Title
EEMUA No. 144	90/10 Copper Nickel Alloy Piping for Offshore Applications: Tubes Seamless and Welded (Sections 1 and 2)
EEMUA No. 145	90/10 Copper Nickel Alloy Piping for Offshore Applications: Flanges -Composite and Solid (Sections 1, 2 and 3)
EEMUA No. 146	90/10 Copper Nickel Alloy Piping for Offshore Applications: Fittings (Sections 1, 2, 3 and 6)
EN 10204	Inspection Documents for the Delivery of Metallic Products
MSS SP 25	Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP 43	Wrought Stainless Steel Butt-Welding Fittings
MSS SP 45	Bypass and Drain Connection Standard
MSS SP 55	Quality Standard for Steel Castings for Valves, Flanges, Fittings, and Other Piping Components, Visual Method for Evaluation of Surface Irregularities
MSS SP 6	Standard Finishes for Contact Faces of Pipe Flanges and Connecting-End Flanges and Valves and Fittings
MSS SP 75	High Test Wrought Butt Welding Fittings
MSS SP 83	Class 3000 Steel Pipe Unions, Socket-welding and Threaded
MSS SP 95	Swage Nipples and Bull Plugs
MSS SP 97	Integrally Reinforced Forged Branch Outlet Fittings-Socket Welding, Threaded and Butt-welding ends
SNT-TC-1A	Personnel Qualification and Certification in Non-Destructive Testing

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5.0 REQUIREMENTS FOR PIPE, FLAANGES FITTING AND BOLTING FOR PIPEING

5.1 GENERAL REQUIREMENTS

1. All piping materials selected under this specification shall be in compliance with the relevant project specification and this specification.
2. All materials shall be new, clean and free from rust, pits and obvious defects
3. Material selections shall comply with the maximum pressure and temperature limitation as specified in the relevant piping material class (refer to Specification PEGS-0710-PIP-007). The piping and instrumentation diagrams (P&IDs) will designate limits of applicable piping material class.
4. Substitution of equivalent materials is subject to approval of the COMPANY. All requests for substitution shall be accompanied with sufficient data, drawings and descriptive details to permit evaluation by the COMPANY.
5. Piping design pressure is based on flange maximum-allowable working pressure, unless otherwise noted in the piping material class.
6. When required, impact testing shall comply with applicable standards and material specifications.
7. Machined or threaded surfaces shall be preserved by coating with PTT RUSTPROTEC M30.
8. All piping material shall be purchased from COMPANY approved manufacturer list. Material procurement from stockist shall be subjected to COMPANY approval and material procured from stockist shall be subjected to confirmation test. The type/extent of test shall be as per this specification and relevant material specification. Confirmation test plan regarding the extent/type of tests shall be submitted to COMPANY for review/approval.
9. Welding procedure specification (WPS), Procedure qualification record (PQR) and welder/welding operator performance qualification for fabrication of welded pipes/fittings shall be in accordance with PEGS-0790-FAB-001 and ASME Section IX and shall be submitted to COMPANY for review/approval.

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5.2 TECHNICAL REQUIREMENTS

5.2.1 GENERAL

1. Cast iron, ductile or malleable iron, aluminum, or copper alloys and plastic shall not be used in hydrocarbon service.

2. All piping component wall thicknesses specified in the individual Piping Material Class are calculated in accordance with ASME B31.3 and are based on continuous long-term internal design pressure, design temperature, specified corrosion/erosion allowance, the manufacturing tolerance and the threading allowance as applicable. All piping subject to any additional loading such as short term upset conditions, occasional loads, external pressure, thermal loading, live loads, etc. shall be individually assessed to ensure full compliance with ASME B31.3.

3. Pipe and fittings in sizes 1-¼", 2-½", 3-½", 5", 7", 9" and 22" shall not be used. Where equipment is normally provided by a Supplier with connections in any of the above sizes, connections shall be made with suitable swages or reducers to match pipe of approved size. Bushings shall not be used.

   For diameters above 24", sizes 30", 36", 42", 48", 56" and 60" are preferred dimensions.

4. Materials shall conform to impact test requirements specified in ASME B31.3, for the combination of minimum design metal temperature (MDMT) and specified reference thicknesses.

5. Galvanized piping components requiring welding or threading shall be galvanized after fabrication. Electroless-nickel plating may be substituted for galvanizing on certain fittings with COMPANY approval. Galvanized piping shall comply with the requirements of ASTM A123.

6. Deviations from the Piping Material Class may occur due to non-availability or design conditions. These deviations are permissible if they are of an equal or higher standard than the individual Piping Standard requirements, and written approval is given by COMPANY. Piping components not specified on the individual Piping Material Class, shall be treated as specialty piping (SP) items and shall have a specific data sheet for each of the design type, rating and size / dimensions.

7. Piping material supplied for H_2S corrosive environment or an environment where corrosion cracking may occur shall be provided per PEGS-0710-PIP-018 “Piping and Equipment subjected to Intermediate Sour Service”, PEGS-0710-PIP-019 “Piping and Equipment subjected to Severe Sour Service”, PEGS-0842-COR-032 “Materials for Sour Service” and NACE MR 0175 / ISO 15156.

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8. Positive material identification (PMI) shall be carried out for 100% of incoming materials in low alloy carbon steel and corrosion resistance alloy (i.e. austenitic stainless steel and Duplex stainless steel, Ni-alloy based materials). In addition to incoming materials PMI, random PMI (10%) shall be performed on ready installed piping system prior to pressure test or coating operation.

   The positive material identification (PMI) shall be in accordance with API RP 578.

   Vendor/Contractor to develop PMI procedure that shall be approved by COMPANY prior to manufacturing / construction.

   Instruments or methods shall be of the type that will provide quantitative, recordable, elemental composition results for the positive identification of the alloy elements present.

9. All metallic piping size 1 ½" and smaller for hydrocarbon service shall be socket welded except for:

   a) High strength material applicable to 10000 psi API rating classes, which shall be butt welded.

   b) Galvanized system, which shall be joined by threaded connection.

10. All threaded connections shall have taper threads (NPT) in accordance with ASME B1.20.1.

    The use of threaded joints is strictly limited. Limitations are listed in the Piping Material Classes PEGS-0710-PIP-007.

    Unions may only be used where threaded connections are authorized by job specification; in general, their use shall be avoided wherever possible. Furthermore, they shall not be used in the following cases:

    a) Systems ratings 600 and above

    b) Where design temperature is above 250°C

    c) Cryogenic Temperature Service (Design temperatures < -46°C)

    d) Corrosive, Toxic Service (including H_2S gas) and Fuel Gas Service.

11. Wherever NPT threaded connections are specified for instrument connections, the threads shall meet the requirements of ASME B1.20.1 with the exception of the following: The L1 thread-gauging requirement as stated in sections 8.1 and 8.2 of ASME B1.20.1 shall be read as follows:

    a) Gauging External Taper Threads with Ring Gauge (Male Threads)

       During hand tightening, the male fitting shall engage in to the ring gauge by +1/4 to +1 turn more than the start of the first scratch mark on the chamfer zone. The gauge is to be turned towards the body of the fitting.

b) Gauging Internal Threads with Plug Gauge (Female Threads)

During hand tightening, the plug gauge shall engage in to the female fitting by +1/4 to +1 turn below the last thread scratch mark on the chamfer zone. The gauge is to be turned towards the body of the fitting.

12. Normally butt weld elbows shall be used. Miter bends shall not be used except where specifically agreed by the COMPANY (In this case, a specific flexibility analysis of the corresponding line has to be carried out). Use of Miter bends on piping systems requiring more than 5% radiographic examination, or being stress relieved, or being subject to sour, corrosive or severe cyclic services are not permitted in any case.

13. In small bore welded piping (1"½ and smaller), hot or cold-formed bends with a radius of 5D min. may be used in lieu of elbows if and where authorized in the relevant Piping Material Class.

5.2.2 PIPES

5.2.2.1 PIPES MATERIALS

1. Carbon Steel Pipe

Carbon steel pipe shall have a maximum carbon content of 0.23 % by ladle analysis or 0.25 % by product analysis. Maximum carbon equivalent (CE (IIW)) shall be 0.42 % by ladle analysis or 0.44% by product analysis according to the formula:

$$CE\,(IIW) = C + (Mn/6) + (Cr + Mo + V)/5 + (Ni + Cu)/15$$

Where Cr, Mo, V and Cu are not shown on the material certificates, the carbon equivalent shall be 0.40 % by ladle analysis or 0.42 % by product analysis, as calculated in accordance with the formula:

$$CE = C + (Mn/6)$$

All carbon steels material shall be impact tested at -29 ºC (-20 ºF) or at MDMT whichever is lower. The test method and acceptance criteria shall meet the ASME B31.3 (paragraph 323.3), unless more stringent requirement (including lower impact test temperatures) are already required in the product specification. However, carbon steels to API 5L Gr B or to ASTM A106 Gr B may not be impact tested if their nominal wall thickness is not above 12.7 mm (1/2 inch).

2. Low Temperature Carbon Steel Pipe

All carbon steel materials for services at low temperatures (i.e., below -29 °C) shall undergo toughness testing in accordance with the requirements of their reference codes and standards.

Impact testing shall be carried out as per ASTM A370 (or ISO 148) at -50 °F (-46 °C).

Impact values shall meet the requirements specified in ASME B31.3.

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The pipe material shall have maximum carbon content of 0.23 % (by ladle analysis), unless more restrictive requirement are already required in ASTM specification. The manganese content may be increased to 1.30 % max. In that case the carbon equivalent (CE IIW) shall be 0.42 % max (ladle) and 0.44 % max (product).

3. Austenitic Stainless Steel Pipe

Type of austenitic stainless steel pipe to be used is specified in the Piping Material Classes (mainly ASTM A312 TP304L, A312 TP316L, A312 TP321, or A358 Gr.304L, A358 Gr.316L, A358 Gr.321 etc.).

Stainless steel type 321 and 347 shall have carbon content greater than or equal to 0.02%.

Austenitic stainless steel pipes shall undergo an annealing heat treatment in accordance with the corresponding ASTM standards.

All pipes shall be supplied in the de-scaled, pickled, passivated and solution heat treated condition.

Pipe material shall be “dual stamped to SS316/316L and SS304/304L” in accordance with as follows:

- ASTM A312 TP 316/316L (UNS S31600/S31603)
- ASTN A312 TP 304/304L (UNS S30400/S30403)
- ASTM A358 Gr 316/316L (UNS S31600/S31603)

The dual stamped grade provides better mechanical strength and corrosion properties.

Material shall be subjected to an intergranular corrosion test in accordance with ASTM A262 Practice E.

4. DUPLEX AND SUPER DUPLEX STAINLESS STEEL PIPE

Pipe materials shall be in accordance with ASTM A790 Duplex SS (UNS S31803) and Super Duplex SS (UNS S32750).

Duplex and Super Duplex SS material shall comply with the requirements specified in PEGS-0710-PIP-020.

5. FIBERGLASS / GRP PIPE

All technical requirements for the design, manufacture, testing, and installation of fiberglass / GRP pipes shall be in conformance with PEGS-0710-PIP-008, PEGS-0710-PIP-030, PEGS-0710-PIP-031 and ISO-14692, Manufacturer’s recommendations and specific requirements of the Project Particular Specification.

All fiberglass piping system shall be of low smoke emission and low toxicity types (under elevated temperature).

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FRP/GRP Pipe consists of:

a. Inside layer (gel coat or liner): This inside layer shall have a resin content of at least 70%. The gel coat may be reinforced by C glass cloth or woven polyester. It shall be at least 0.5 mm thick.

b. The resin used shall be free of pigment or other additives.

c. Intermediate Layers (providing mechanical strength): These layers shall be of glass-reinforced thermosetting resin (generally, the same resin shall be used as for the gel coat. If not, the resins must be compatible and provide a bonding equivalent or better than identical resins). The resin used must be pigment-free.

d. Outside layer: This generally is made of the same resin (gel coat) used as for the intermediate layers However, subject to the COMPANY prior approval, the Manufacturer may use a resin containing the following additives:

   i. Pigments (for protection against UV)

   ii. Graphite (to decrease the surface electrical resistivity)

   iii. Antimony oxide or alumina (to enhance the self-extinguishing properties).

Carbon fiber may also be inserted in outside layer to insure electrical conductivity.

Resins:

The only acceptable synthetic thermosetting resins are epoxy resins and vinyl ester resins. Isophthalic or orthophthalic polyester resins shall not be used. However, in the case of fluids having a high content of especially corrosive chemicals, selection shall be made taking into account Manufacturer's recommendations and polyester of the isophthalic, orthophthalic or bisphenol type could be eventually considered.

Glass fibers:

Two types of glass, having different chemical compositions, can be used to reinforce thermosetting resins (they are known as "C" glass, and "E" glass):

- Inside Layer

"C" glass is used in the form of light-weight fabrics (30 to 50 g/m2) to reinforce the gel Coat

- Layer Providing Mechanical Strength

“E” glass is a reinforcing glass for the layers of composite materials providing mechanical strength. It is used in various forms: rovings, mats, fabrics, chopped fibers.

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Fabrication:

All materials and fabrication methods shall comply with API 15LR “Specification for Low Pressure Fiberglass Line Pipe”, and ASTM D2996 “Filament-Wound Fiberglass (Glass Fiber-Reinforced Thermosetting-Resin) Pipe”.

6. 90/10 Cu-Ni Pipe

Copper/Nickel material shall comply with the requirements as specified in PEGS-0710-PIP-012.

Pipe shall be supplied in the annealed condition. Dimensions shall be in accordance with EEMUA publication No 144. Pipe up to and including 14 inches Size shall be seamless. Pipe 16 inches Size and larger shall be seamless or welded with all longitudinal weld seams being 100 % radiographed as per EEMUA publication No 144, section 2. The nominal EEMUA rating for wall thickness sizing shall be 20 bar as a minimum. 100 % internal visual inspection shall be performed to confirm the absence of manufacturing defects.

5.2.2.2 PIPES DIMENSIONS

- Thicknesses

Pipes for which schedules 10, 40, 80, etc. are specified shall be in accordance with the standard ASME B36.10M.

Pipes for which schedules 5S, 10S, 40S and 80S are specified shall be in accordance with the standard ASME B36.19M.

Unless specified otherwise on the individual Piping Material Class, for non-schedule pipe the minimum wall thickness permitted shall be within allowable manufacturing tolerance (Mill Tolerance) as below. The pipe wall thickness may be thicker than specified only after written approval has been given by COMPANY. Corrosion allowance shall be as per the relevant Piping Material Class.

- Mill Tolerance

The mill tolerance on wall thickness shall be as follows:

  - Minus 8 % for diameters 18 and above
  - Minus 12.5 % for diameters up to 16 inches.

- Lengths

Pipe shall preferably be supplied in double random lengths. Single random lengths will be accepted where specified in the Job Specification or for small diameter pipes or where double random lengths are unavailable.

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The standard pipe lengths shall never be less than:

- 5.33 m (17.5 ft.) for diameters up to and inclusive of 4 inches
- 10.51 m (35 ft.) for diameters 6 inches and above.

However, provided that they are limited to 5% of the total length of the delivery, certain sections may have a minimum length equal to half these values.

5.2.2.3 PIPES ENDS

- Plain Ends (or Square)

Pipes less than 2 inches in diameter and made of carbon steel, stainless steel, copper alloys or alloy steel shall be delivered with plain (or square) ends.

- Bevel Ends

Pipes 2 inches or more in diameter and made of carbon steel, stainless steel, copper alloys or alloy steel shall be delivered with beveled ends as per the standard ASME 16.25.

- Threaded Ends

Threaded pipes connected by couplings shall be supplied with threaded coupling; couplings shall be threaded per ASME B1.20.1.

The ends of galvanized steel pipes up to 2 inches in diameter must be threaded in accordance with ASME B1.20.1.

Threads of galvanized pipes and couplings shall be free of galvanizing.

5.2.2.4 MANUFACTURE

- Fabrication of Pipes
  - Seamless Pipes

    Seamless pipes shall be provided for carbon steel and stainless steel pipes with pipe diameters ranging from ½ inch to 16 inches and from ½ inch to 6 inches for duplex stainless steel pipes.

    Seamless pipes shall be hot drawn and produced by the plug mill process unless specified otherwise in the requisitions issued by the COMPANY.

    TMCP (Thermo Mechanical Control Process) steel shall not be used for fabrication of pipe.

    Pilger mill process is not acceptable. However it may be accepted with prior approval from COMPANY subject to below limitations:

    - Ratio of thickness to diameter of pipe is above 10%.
    - Products are used for straight sections only.

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- Material grades are carbon steel or low alloy steel.
- A formal technical audit has been performed by the COMPANY less than six months ahead of the purchase order.
- Heat material and product traceability is complete along the full manufacturing process starting from the initial ingot. The ingot is coming from identified and approved sources.
- Heat treatment sequence shall be approved. Material is delivered in quenched and tempered conditions unless otherwise specified. Final heat treatment shall be performed simultaneously from inside and outside of the pipe.
- Extent of microstructure examination shall be agreed. The extent of the examination shall verify that the manufacturing process does not alter the microstructure of the product (on its entire length). Such examination will be settled and agreed on with the Manufacturer for its frequency, location on products for each heat number, batch of treatment and production line.
- Weldability tests are required on material of the supply unless otherwise agreed.
- Considering that such heavy wall pipes are due for high pressure service, the whole external and internal surfaces are machined as to eliminate all defects inherent to the process. Manual grinding is prohibited for that purpose.
- External and internal surfaces are then fully inspected by DPI or MPI and are free from any linear indication.
- The inspection and test plan shall clearly identify the sequence of operations from receiving ingot. Each process production operation, heat treatment, surface preparation and nondestructive operation shall be individually and sequentially identified by that document.
- Local weld repair on pipe is not allowed.

o Longitudinally Welded Pipes

Longitudinal welded pipes can be provided for larger pipe diameters. ERW welding process is not acceptable. For carbon steel, the SAW process shall be used exclusively. COMPANY approval shall be required for the welding process prior to placing the order.

A weld joint factor of 1.00 shall be guaranteed.

The weld seam shall also be welded on the inside (back-welded) if the welding process used does not ensure:

- Full penetration
- Weld reinforcement of uniform thickness
- Free of appreciable distortion

The weld seams shall be subjected to full length (100%) radiographic inspection by X-ray method onto radiographic films (Fluoroscopic inspection is not acceptable). The acceptance standard for radiography shall be in accordance with applicable material specification.

o Jointers

Circular welds jointers to attain the minimum allowable length are not permitted unless authorized by COMPANY on a case by case basis.

- Machining

o Bevels

Any beveling of the ends of the pipes shall be performed by flame-cutting. The process used shall assure the production of clean, square, burr-free bevel cuts. Wherever flame-cutting is employed, all oxides and traces of previously melted metal shall be removed by grinding or machining. For stainless steel pipe, cutting and beveling shall be performed by mechanical means only; flame cutting is not permitted.

o Weld Reinforcement

The inside reinforcement of the weld must be ground-off over a length of 10cm at each end of the pipe and must leave a gradual transition.

- Repair of Defects

Repairs of defects shall be performed in accordance with the applicable material specifications and code/standard, however repair of base metal by welding is not permitted.

- Marking

Each length of pipe shall be marked legibly by low stress die-stamping or by engraving or by stenciling. Stencil marking shall utilize water insoluble ink. The ink shall not contain any harmful metal or metal salts such as zinc, lead or copper which cause corrosive attack on heating. Stainless steel piping shall be supplied with permanent marking over the entire length.

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5.2.3 FITTINGS

5.2.3.1 FITTINGS MATERIALS

1. CARBON STEEL FITTINGS

Carbon steel fittings shall conform to ASTM A234 or A105N with the same material requirements as specified for carbon steel pipe.

The carbon steel used for the fabrication of fittings shall be produced in an electric furnace or by the basic oxygen process.

TMCP (Thermo Mechanical Control Process) steel shall not be used for fabrication of fittings.

Carbon steel fittings shall be supplied with maximum carbon content of 0.23 % (ladle) or 0.25 % (product) and a (CE (IIW)) shall be 0.42 % max (ladle) or 0.44% max (product).

The carbon equivalent of these material, calculated using the formula:

$$CE\,(IIW) = C + (Mn/6) + (Cr + Mo + V)/5 + (Ni + Cu)/15$$

Where Cr, Mo, V and Cu are not shown on the material certificates, the carbon equivalent shall be 0.40 % by ladle analysis or 0.42 % by product analysis, as calculated in accordance with the formula:

$$CE = C + (Mn/6)$$

All carbon steels materials of thicknesses greater than 12.7 mm (1/2 inch) shall be impact tested at -29 ºC (-20 ºF) or at MDMT whichever is lower. The test method and acceptance criteria shall meet the ASME B31.3 (paragraph 323.3), unless more stringent requirement (including lower impact test temperatures) are already required in the product specification.

2. LOW TEMPERATURE CARBON STEEL FITTINGS

Carbon steel and alloy steel piping fittings for “low temperature service” shall conform to ASTM A420 or ASTM A350 LF2 with the same material requirements as specified for low temperature carbon steel pipe.

All carbon steel materials of service at low temperatures (i.e., below -29 ºC) shall undergo toughness testing in accordance with applicable code and material specification.

3. AUSTENITIC STAINLESS STEEL FITTINGS

Where austenitic stainless steel fittings are specified, they shall be in conformance with ASTM A182 or A403 with the same material requirements as specified for austenitic stainless steel pipe.

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4. DUPLEX AND SUPER DUPLEX STAINLESS STEEL FITTINGS

Duplex Stainless Steel fittings shall be supplied as per ASTM A815 with the same material requirements specified for duplex stainless steel pipe.

5. FIBERGLASS / GRP FITTINGS

Fiberglass / GRP fittings shall be supplied as per same material requirements as specified for fiberglass / GRP pipe.

Preference shall be given to accessories produced by filament winding, since they have greater mechanical strength.

Accessories shall have at least the same chemical and mechanical properties (with respect to bursting, crushing, axial and longitudinal strength) as the tubes on which they are intended to be fitted.

6. 90/10 CU-NI FITTINGS

90/10 Cu-Ni fittings shall be supplied as per same material requirements as specified for 90/10 Cu-Ni pipe.

Material shall have a nominal 90/10 Cu-Ni-Fe composition complying with UNS C70600 and dimensions shall be in accordance with EEMUA publication No 146.

All Cu/Ni elbows, tees, saddles and insert self-reinforcing branch connectors shall be provided with proof burst test certificates and radiography certificates (where applicable) to demonstrate compliance with the specification. Proof testing shall meet ASME B16.9 Section 9 requirements.

Seamless and welded copper alloys fittings shall be annealed.

5.2.3.2 FITTINGS DIMENSIONS

Metallic pipe fittings shall be supplied with wall thickness and nominal sizes that meet the requirements of ASME B36.10M, ASME B36.19M, ASME B16.9, ASME B16.11 and where allowed, ASME B16.28, MSS SP 95.

- Thicknesses
  - o Carbon Steels and Low Alloy Steels

    The thicknesses of fittings must be in accordance with the standards ASME B36.10M, except for the under mentioned tolerance for butt weld elbows above 14 inches nominal bore, which are additional to those, stated in the ASME B16.9. Note that the negative wall thickness tolerance for elbows larger than 24 inches is more stringent than ASME B16.9.

Table 2 - Wall Thickness Tolerance for Elbow

Wall thickness tolerance at any point of elbow ends		
Size	**Plus tolerance**	**Minus tolerance**
16” to 24” Wall thickness 12.7 mm and greater	15%	12 ½%
16” to 24” Wall thickness Less than 12.7 mm	20%	12 ½%
Larger than 24”	20%	10%

All 90º butt weld elbows shall be long radius (1.5D) unless space limitations dictate otherwise and COMPANY approval is given.

o Stainless Steels

The thicknesses of fitting must comply with the standard ASME B36.19M, except that tolerance only for fittings in schedule 10S shall be in accordance with MSS SP 43.

- Other Dimensions

Dimensions of forged, socket welding and threaded fittings shall be in accordance with ASME B16.11.

Dimensions of metallic butt welding fittings shall be in accordance with ASME B16.9, except that tolerance for stainless steel fittings in schedule 10S shall be in accordance with MSS SP 43.

The dimensions of weldolet, sockolet, threadolet and similar fittings shall comply with MSS SP 97.

For branch connection fittings, i.e. weldolets, sockolets, sweepolets, etc., the vendor must confirm in his quotation that such fittings comply with the requirements of the ASME B31.3, and advise/ confirm the outline dimensions in his quotation.

For fittings in diameters greater than the limits set by the standards ASME B16.9 and MSS SP 43, the vendor must submit a dimensional document and calculations notes to the COMPANY for approval.

5.2.3.3 FITTINGS ENDS

- Bevel Ends

All butt welding, including the stainless steel fittings in schedule 40S and 80S, shall have ends beveled in accordance with the standard ASME B16.9.

The ends of stainless steel fittings in schedule 10S shall be in accordance with MSS SP 43.

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- Socket Welding Ends

The ends of socket welding fittings, including sockolets, shall comply with the standard ASME B16.11.

- Threaded Ends

The ends of threaded fittings, including threadolets, shall be in accordance with the standard ASME B16.11, and shall be threaded per ASME B1.20.1 (NPT). Bushings, street elbows and close nipples may be used only with permission of the COMPANY. Thread sealant such as “three bond sealant” and “thread locker” shall be used. Threaded half couplings are prohibited.

Threading of galvanized fittings shall be free of galvanizing.

5.2.3.4 MANUFACTURE

- Fittings up to 1-½ inches in diameter

All fittings up to 1-½ inches in diameter, of the 3000#, 6000# and 9000# series, shall be forged.

Fittings machined from bars are not acceptable.

- Fittings 2 inches and above in diameter
  - o Seamless Fittings

    Seamless fittings shall be forged or extruded.

  - o Welded Fittings

    Welding fittings shall be made from forgings, welded tubular elements and plates.

    The weld shall be made by an approved process.

    The weld seam shall also be welded on the inside (back-welded) if the welding process used does not ensure:

    - Full penetration
    - Weld reinforcement of uniform thickness
    - Free of appreciable distortion

    "Fabricated" fittings (mitered elbows, reductions, etc.) shall consist of a single rolled and welded plate. However, fabricated fittings may, if necessary, be made with two longitudinal welds.

    Welding of components used for joining unequal wall thickness and/or yield strength materials shall be beveled in accordance with ASME B16.25. The properties of the welding material shall correspond to the higher strength material.

All welded carbon steel fittings shall be supplied in stress relieved or normalized condition unless agreed otherwise. A production test shall be performed on the maximum thickness of welded CS fittings to confirm the SMYS, UTS and Charpy absorbed impact energy in base material, weld and heat affected zone have been maintained after PWHT. The recorded values shall be above the minimum specified values so as to allow for further degradation possible after any PWHT of circumferential butt welded joints.

For all "fabricated" fittings, the vendor shall submit, with his quotation, drawings showing all dimensions and tolerances of the fittings offered, giving details of method of manufacture, heat treatment (including PWHT), showing location of all welds, with joint details, for review by COMPANY.

For fittings made of carbon steel, the beveled surface of the welding end shall be subjected to wet magnetic particle examination in accordance with practice ASTM E709. Personnel performing the examination shall be qualified in accordance with SNT-TC-1A level II.

For fittings made of wrought austenitic stainless steel, preferably, bevel ends shall be liquid penetrant tested in accordance with Practice ASTM E165. Personnel performing the examination shall be qualified in accordance with SNT-TC-1A level II.

All welds shall undergo radiographic examination in accordance with the reference codes and standards. Hardness testing is also required in case of H_2S service.

- o Machining
  - ▪ Bevels

    Any beveling of the ends of the fittings may be performed by machining or by flame cutting. The process used shall produce clean, square, burr-free cuts. Whenever flame-cutting is employed, all oxides and traces of previously melted metal shall be removed by grinding or machining. For stainless steel, only mechanical means shall be employed; flame cutting is not permitted.

  - ▪ Weld Reinforcement

    The inside reinforcement of the weld must be ground-off at each end of the fittings; this machining shall be performed in such a way as to leave a gradual transition.

- Repair of Defects

Repair of defects shall be performed fully in accordance with the reference codes and standards, however repair of base metal defects by welding is not permitted.

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5.2.3.5 CLEANING

Fittings made of the following materials:

- Austenitic stainless steels
- Duplex stainless steels
- UNS 06625 grade 1 material shall be chemically cleaned (pickling and passivation).

5.2.4 FLANGES

5.2.4.1 GENERAL

All flanges in butt weld (BW) piping shall be weld-neck (WN) unless specific requirements dictate otherwise.

Flat face flanges shall only be used when specified in the Piping Material Classes such as for interface with GRP piping systems. When flat face flanges are used they shall be used with full face gaskets.

Weld-neck flanges and socket-weld flanges shall be provided with bore to match the attached pipe.

Weld overlay shall be used when joining metal flanges from dissimilar piping materials that are prone to galvanic corrosion.

Any substitution of materials shall require the prior approval of the COMPANY.

The replacement of flanges of a specified schedule by a higher schedule must be submitted to COMPANY for approval. In such a case, internal tapering will be necessary to match the specified schedule. The slope of this tapering shall comply with the reference standards.

5.2.4.2 FLANGES MATERIALS

1. CARBON STEEL FLANGES

   The carbon steel used for the fabrication of the flanges shall be produced in an electric furnace or by the basic oxygen process**.**

   All carbon steels, including normalized steels, used for the fabrication of flanges shall have a maximum carbon content of 0.23% (ladle) and 0.25% (product) and a carbon equivalent (CE IIW) of 0.42% max (ladle) and 0.44% max (product).

   All ASTM A350 LF2 flanges shall be of class 1.

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All flanges shall be hot forged and shall undergo an appropriate heat treatment after forging with the following order to preference:

- Quenching and tempering
- Normalization and tempering
- Normalization.

2. CARBON STEEL GALVANISED FLANGES

Where galvanized flanges are specified, electro-deposited coating of zinc is not acceptable.

Galvanized standard shall comply with the requirements of ASTM A123.

3. STAINLESS STEEL FLANGES

Stainless steel flanges shall be in conformance with ASTM A182.

Stainless steel flanges shall undergo an annealing heat treatment in accordance with the relevant ASTM standards. Material requirements for stainless steel flanges shall comply with the same requirements as specified for pipe material.

4. DUPLEX STAINLESS STEEL FLANGES

Duplex Stainless Steel flanges shall be supplied as per ASTM A182 with the same material requirements specified for duplex stainless steel pipe.

Duplex and Super Duplex SS material shall comply with the requirements specified in PEGS-0710-PIP-020.

5. FIBERGLASS / GRP FLANGES

Note: All technical requirements for the design, manufacture, testing, and installation of fiberglass / GRP piping shall be in conformance with PEGS-0710-PIP-030, PEGS-0710-PIP-031

The fixed flanges can be added on and glued to the tube or fitting or be fabricated directly on a piping or accessory end.

They can be fabricated by the winding of rovings or fabrics, or by hot pressure moulding with a reinforcement of chopped glass fibers.

6. 90/10 CU-NI FLANGES

Copper/Nickel material shall comply with the requirements specified in PEGS-0710-PIP-012. The flanges material shall have a nominal 90/10 Cu-Ni-Fe composition complying with UNS C70600 and flange dimensions shall be in accordance with EEMUA publication No. 145.

Copper alloy flanges shall undergo heat treatment in accordance with their respective ASTM standards.

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5.2.4.3 FLANGES DIMENSIONS

Flange dimensions of slip-on flanges, lap-joint flanges, socket-welding flanges, threaded flanges and welding-neck flanges shall be in accordance with ASME B16.5 for diameters up to 24 inches.

The dimensions of welding-neck flanges and blind flanges 26 inches or more in diameter shall be in accordance with ASME B16.47 Series A.

For flanges in diameters and series greater than the limits set by ASME B16.5 and ASME B16.47 Series A, the Manufacturer shall submit a dimensional document and calculation notes to the COMPANY for approval.

- Thicknesses

The end thickness of welding-neck flanges and the bore dimensions of socket-welding flanges schedules 10, 40, 80, etc., shall be in accordance with API 5L or ASME B36.10M.

The end thickness of welding-neck flanges schedules 10S, 40S or 80S shall be in accordance with ASME B36.19M.

- 5000 and 10000 psi Flanges

The dimensions of API 5000 and API 10000 psi flanges shall be in accordance with API 6A/ISO10423.

- Other Dimensions

Nonmetallic flanges shall generally meet the bolting dimensions of the above standards and be suitably face finished to mate with ASME B16.5 flanges. However, the flange thickness and hub dimensions of the non-metallic flanges may vary depending on the material used.

For FRP/GRP flanges, in particular the bolt-hole circle, the bolt-hole diameter and the outside diameter, shall be in accordance with the values specified in the standard ASME B16.5 for the relevant ratings.

- Hub Connectors

Hub connector dimensions shall be as per Manufacturer standard. The design shall be supported by design calculations using Finite Element Analysis (FEA). The design shall be in compliance with ASME B16.5 or API SPEC 6A / ISO 10423 whichever is applicable.

5.2.4.4 FLANGE ENDS

- Welding Neck Flanges

Welding-neck flanges up to 24 inches in diameter shall have ends beveled as per ASME B16.5.

The ends of flanges 26 inches or more in diameter shall comply with ASME B16.47 Series A.

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- Socket Welding Flanges

The ends of socket-welding flanges shall comply with ASME B16.5.

- Threaded, Galvanized Flanges

Threads of galvanized flanges shall be free of galvanizing.

5.2.4.5 MANUFACTURE

After forging, by stamping or circular rolling, all flanges shall undergo the following main machining operations:

- Flanges Faces Finish
  - o Metallic Flanges

    The gasket contact faces finish of metallic flanges (except Cu/Ni and copper alloy) may be of three types:
    - Flat face
    - Raised face
    - Grooved for ring joint.

  These contact faces shall undergo finishing machining comply with MSS SP 6 as indicated by the table hereafter:

Table 3 - Average Roughness for Flange Facing

Flange facing	Finish	Average roughness (maximum value)
Flat Face	Concentric serrated or spiral serrated	250 AARH – 500 AARH (6.3 microns – 12.5 microns)
Raised Face 1/16" (with flat gasket)	"Stock Finish"	250 AARH – 500 AARH (6.3 microns – 12.5 microns) for the "Stock Finish" type (see Note 1)
Raised Face 1/16" or Raised Face 1/4" (with spiral wound gasket)	Smooth Finish	125 AARH – 250 AARH (3.2 microns – 6.3 microns)
RTJ (see Note 2)	Groove: very smooth	63 AARH (1.6 microns)

Note 1: The "stock finish" facing is not defined in MSS SP 6. For Raised Face (stock finish) facing, the roughness average range is 6.3 to 12.5 microns (AARH = 250 to 500 micro-inches). Pitch and depth of machining groove shall be per Table 1 of MSS SP 6. However, roughness in excess of 12.5 microns (AARH greater than 500 micro-inches) is acceptable to a maximum of 50 microns, provided groove parameters per Table 1 of MSS SP 6 are maintained.

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Note 2: The minimum BRINELL hardness of grooves of RTJ flanges shall be:

- 110 for carbon steel flanges
- 160 for alloy steel flanges
- 150 for stainless steel flanges
- 20 Brinell harder than the gasket.

For Cu-Ni and Copper alloys flanges contact face shall be stock finish and roughness values shall be as specified in table 3.

o Non Metallic Flanges

The contact face of the FRP/GRP flanges must be perfectly perpendicular to the centre line of the tube; it shall be designed for a gasket extending out to the outside diameter of the flange.

This contact face must be naturally flat and rough-wound or rough-moulded, without retouching. It is forbidden to grind it, even if the glass fibers are intended to be covered with a coat of resin after grinding

Contact face shall have grooves in relief (at least 2) to hold the gasket in place.

- Bore

The bores of flanges, as a function of their diameters, shall comply with ASME B16.5 or ASME B16.47 Series A.

- Internal Threading

The internal threading of threaded flanges shall comply with ASME B1.20.1 (NPT).

- Drilling

Bolt holes shall be made by multi-spindle drills. This drilling shall comply with ASME B16.5 or ASME B16.47 Series A, depending on the flange diameter (24 inches and less or 26 inches and above).

The spot facing of the flanges at the bolt holes shall be in accordance with MSS SP 9.

The orifice flanges shall be in accordance with ASME B16.36.

Orifice flanges and instrumentation flanges, of sizes 2 inches, 3 inches and 4 inches shall have bolt-hole diameters 1/16 inch smaller than that indicated in ASME B16.5 (custody transfer metering applications only). General requirements for instrumentation shall comply with PEGS-0710-INS-002.

- Repair of Defects

Repair of defects shall only be permitted in accordance with the reference codes and standards, however repair of base metal by welding is not permitted.

5.2.4.6 JACK SCREWS

Jack screws, 180° apart, shall be provided, one on each flange, for all orifice assemblies.

Carbon steel flange bolting shall use stud bolting with material conforming to the Piping Material Classes Sheets and threaded full length. Reduced shank stud bolts shall not be used.

Nuts shall be as specified on the Piping Material Classes Sheets. Corrosion protection shall be in accordance with section 5.2.5.4 (Protection against corrosion).

5.2.5 BOLTING

5.2.5.1 GENERAL

The bolts, studs and nuts shall be in accordance with the relevant piping material class. For dissimilar metal flanges, bolting shall be stainless steel or duplex stainless steel with PTFE Fluoropolymer coating.

Bolting requirements shall be in accordance with API 20E.

All stud bolts shall be Class 2A fit and nuts shall be Class 2B fit. To take into account the additional thickness provided on the studs due to galvanizing, the dimensional tolerances on mating threads shall be achieved either by undercutting the male thread or overcutting the female thread.

Bolting and nuts shall be supplied with nuts engaged and packed for shipment to prevent damage to the coatings.

5.2.5.2 BOLTING MATERIALS

The steels used for the fabrication of the bolting shall be produced in a MARTIN furnace, in an electric furnace, or by the basic oxygen process.

All parts shall undergo thermal hardness treatments in accordance with the requirements of the applicable codes and standards.

Except as otherwise specified in the order, only bolting specified to standard ASTM A320 or for low-temperature service shall undergo toughness tests.

5.2.5.3 BOLTING DIMENSIONS

- Stud Bolts and Screws

  The diameters and lengths of stud bolts and Hex screws ("Heavy" series) shall comply with the standards ASME B16.5 and ASME B18.2.1 and shall conform to the dimensions shown on the materials requisitions.

  Diameters shall be in inches, and lengths shall be in millimeters.

  The lengths given on the requisitions are service lengths that do not include the dimensions of the end bevels.

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Hydraulic bolt tensioning is mandatory for all bolt sizes for Hot Oil service and stud bolts diameter greater than 1-½ inches for other services. The length of these stud bolts shall be increased by a minimum of one nut thickness to allow the use of hydraulic bolt tensioning equipment

- Nuts

All nuts shall be of the hexagonal type ("Heavy" series) and shall be in accordance with the ASME B18.2.2 and oversized, as necessary, to accommodate the stud bolt coating system (refer to PEGS-0842-COR-010/011).

5.2.5.4 MANUFACTURE

Stud bolts and nuts may be machined from treated steel rods. However, nuts may also be forged.

Screws shall be made by die-working the heads.

After these operations of forging and die-working, the bolting shall undergo the hardness treatments required by the relevant codes and standards.

- Threading

Threading shall be in conformity with the following series of standard ASME B1.1:

  - "Coarse" series: for diameters less than or equal to 1 inch
  - "8 threads" series: for diameters equal to or greater than 1-1/8 inches.

Stud bolts shall be threaded along their entire length. The machining and surface-condition tolerances applicable to the various threading shall be in conformity with the following classes:

  - Class 2A of standard ASME B1.1 for stud bolts and screws
  - Class 2B of standard ASME B18.2.2 for nuts.

- Protection Against Corrosion

The bolting shall be protected against corrosion as per PEGS-0842-COR-010 and PEGS-0842-COR-011.

Bolting can be ordered as mentioned in the requisition, either with long lasting corrosion protection such as dip galvanizing and PTFE coating or only a temporary protection (application of PTT RUSTPROTEC M30).

Manufacturer has to submit relevant procedure to COMPANY approval.

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5.3 INSPECTION

5.3.1 QUALITY ASSURANCE / QUALITY CONTROL

Manufacturer shall operate a Quality Assurance system in accordance with ISO 9001 or ISO / TS 29001, or internationally recognized standard approved by a COMPANY.

COMPANY and Contractor shall have access to Manufacturer's plant at all times and shall be at liberty to inspect the work at any stage to ensure compliance.

The inspection and tests necessary to confirm that the products meet the requirements of the standard, specifications and requisition shall be carried out in the Manufacturer's plant by the Manufacturer's authorized inspection representative independent of manufacturing department.

Products shall be guaranteed by Manufacturer by an inspection certificate (conformity, material, test, etc.).

All tests shall be performed by ISO/IEC 17025 certified laboratories having accreditation for the required test methods.

All activity associated with quality requirements shall comply with PEGS-0710-ADM-006 (Quality Requirements for Vendor).

Four weeks prior to commencement of the manufacturing, Manufacturer shall prepare and submit a Quality Control Plan (QCP) or Inspection and Test Plan (ITP) which describes the tests and inspections to be performed during the supply of the materials. The QCP (or ITP) shall set forth "Witness (W)", "Hold (H)", "Review (R)" and "Monitor (M)" points and shall have approval from COMPANY prior to commencement of manufacturing.

Contractor shall undertake inspection at Manufacturer's plant as per approved QCP or ITP. Contractor shall provide advance notification to COMPANY to enable its representative to attend W and H points as indicated in approved QCP / ITP.

If Manufacturer does not have the necessary means of examination, these tests may be carried out by an agency and at a place approved by the COMPANY.

5.3.2 ACCEPTANCE

As a minimum, following witness inspection shall be conducted by Contractor's representative:

- Visual examination
- Dimensional check
- Marking and finishing conditions.

Inspection shall be based on sampling and it shall cover at least 5% of each of the items submitted for acceptance. The non-conformity of any or all of the products submitted for acceptance may give rise either to a second submission after the products have been corrected, if this is possible or to final rejection.

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5.4 MATERIAL CERTIFICATION

5.4.1 GENERAL

All piping materials (pipes, fittings, flanges and bolts/nuts) shall be supplied with material certificates conforming to European Standard EN 10204, Type 3.1.

5.4.2 TYPE APPROVAL/TEST AND PROOF TEST CERTIFICATES

Type Test and Proof Test Certificates where specified or required by applicable specification shall be a certificate issued by an independent authority with ISO/IEC 17020 type A accreditation acceptable to COMPANY stating that similar equipment/materials being supplied have undergone tests to meet all technical specified requirements and have been found acceptable.

The validity period of the certificate shall be current at the time of dispatch of the equipment/materials, and shall cover the size and rating range of the equipment/ materials being supplied.

5.5 PREPARATION FOR SHIPMENT

5.5.1 MARKING

Markings required by Section 18 of MSS SP 25, shall not be omitted.

In addition to the marking required by MSS SP 25, for all piping materials (except for bolts and nuts), the following information shall be marked by cold stamping:

- Specification and grade of material
- Heat number
- Batch number
- Rating for flange
- Diameter, for flange
- Ring joint number, for RTJ flange.

However, pipes and fittings less than 3mm thickness shall not be marked by stamping but by etching.

In case of bolting, in addition to the markings required by the reference standards, the grade of steel and the maker's mark shall be cold stamped on each bolting element. The marking shall be located on one of the ends of each stud bolts and one of the flats of each screw head and each nut.

Specific marking requirements shall be indicated in the COMPANY requisition.

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5.5.2 PROTECTION

Threaded ends of all carbon steel piping items shall be greased. All carbon steel pipes shall be protected by a female cap at one end and by the specified threaded coupling at the other end.

The beveled ends shall be protected by a peel-off varnish.

All stainless steel piping materials shall be protected against the risks of saline corrosion during cleaning, transport, fabrication, testing and storage. If paint is used to protect, it must not contain chlorides or other substances that might damage the stainless steel.

Specific means of protection, additional to those already mentioned in this specification shall be indicated in the COMPANY requisition.

5.5.3 PRESERVATION

Seaworthy packing shall be used for all piping (pipes, flanges, fittings and bolting). In the case of austenitic stainless steel, the packing must also be water proof. Packing must be suitable for all stages of transport (rail, road, air, sea, etc.).

The Supplier shall provide a detailed preservation and shipping procedure for COMPANY's approval and recommendations for handling and storage at job site.

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6.0 APPENDICES

N/A

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EMS User Feedback Form

This section for feedback provider input only

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Location:	
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